A STUDY OF THE PRESIDENTIAL INTERNSHIPS IN SCIENCE AND ENGINEERING

Charles Edward Cater

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

A STUDY OF THE PRESIDENTIAL INTERNSHIPS
IN SCIENCE AND ENGINEERING

by

Charles Edward Cater
and
Thomas Brock Korsmo

June 1974

Thesis Advisor: J. W. Creighton

Approved for public release; distribution unlimited.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A Study of the Presidential Internships in Science and Engineering		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis; June 1974 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Charles Edward Cater and Thomas Brock Korsmo		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		12. REPORT DATE June 1974 13. NUMBER OF PAGES 85
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Naval Postgraduate School Monterey, California 93940		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Presidential Internships
Interns
Federal Laboratories

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A survey of scientists and engineers who participated in the Presidential Internships in Science and Engineering Program was conducted by a questionnaire to determine the effectiveness of the program in meeting its objectives and to identify some of the characteristics of the Interns.

Results showed that most interns perceived the program to have helped them obtain employment in their respective fields. A majority of the laboratories did not utilize this program to obtain special skills or normally

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
(Page 1) S/N 0102-014-6601

 SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20.

unobtainable talent. No correlation was found between the interns and any innovator characteristics.

The report summarizes responses to each question and recommends the direction of future research.

A Study of the Presidential Internships in Science and Engineering

by

Charles Edward Cater
Lieutenant Commander, United States Navy
B.S.E.E., University of Washington, 1962

and

Thomas Brock Korsmo
Lieutenant Commander, United States Navy
B.S., United States Naval Academy, 1961

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
June 1974

ABSTRACT

A survey of scientists and engineers who participated in the Presidential Internships in Science and Engineering Program was conducted by a questionnaire to determine the effectiveness of the program in meeting its objectives and to identify some of the characteristics of the Interns.

Results showed that most interns perceived the program to have helped them obtain employment in their respective fields. A majority of the laboratories did not utilize this program to obtain special skills or normally unobtainable talent. No correlation was found between the interns and any innovator characteristics.

The report summarizes responses to each question and recommends the direction of future research.

TABLE OF CONTENTS

I. INTRODUCTION

The Presidential Internships in Science and Engineering Program was initiated in 1971 under the administrative control of the National Science Foundation, with funding being provided by the Department of Labor.

This program enabled unemployed or underemployed scientists and engineers holding advanced degrees to work for a year at Federal Research and Development laboratories. A one year nonrenewable stipend of up to $7,000 per year was granted to each intern with the laboratory providing matching funds or, in many cases, larger amounts.

The internships were intended to help the scientists and engineers to broaden their work experience, thereby facilitating their transition to future jobs needed by society. To this end, a total of 557 scientists and engineers were granted internships at 72 laboratories before the program was concluded in the spring of 1973.

II. PURPOSE

This study was initiated in an effort to measure the effectiveness of the Presidential Internships in Science and Engineering Program. The specific objectives of the study are as follows:

1. To determine if the program helped the interns to obtain employment in the science or engineering fields.

2. To determine if the interns provided the laboratories with a specialized talent.

3. To determine how long it took the interns to become productive members of their laboratories.

4. To determine what effect the internship had on influencing the interns to seek a doctorate.

5. To determine if the interns' salaries and advancement patterns were equivalent to those of their contemporaries.

6. To determine if the internship increased the interns' capability for technology transfer.

7. To determine how technical information was transferred between the interns and other members of the laboratory, and to examine how information was obtained by laboratory members.

8. To determine if there were identifiable barriers to the transfer of technology between the interns and other members of the laboratory.

9. To determine some of the characteristics of the interns involved. Of particular interest are those characteristics that can be associated with the linker and stabilizer concepts described by Creighton, Jolly, and Denning [Ref. 4].

10. To determine if specific intern characteristics were related to their performance at the laboratory.

III. CONCEPTS

During the period in which the Presidential Internships in Science and Engineering Program was initiated, highly qualified young scientists and engineers were enduring a particularly high unemployment rate. Dr. Edward E. David, Jr., Science Advisor to the President, commented that "these unemployed people could provide a unique source of skills and resources, much of which was developed at taxpayers' expense in colleges, universities, and various laboratories." In a sense, these people represented a vital national resource that was not being effectively utilized.

Concurrently, there was a growing need throughout the country for research in such areas as pollution control, trash disposal, management and integration of large projects, and the nuclear field in areas as diverse as new power systems or criminal and medical laboratories. The internship program could provide temporary employment for scientists and engineers, expose the trainees to both the problems and the capabilities of government research and development, and seed technological specialists into the mainstream of government units which had previously not been able to afford such expertise.

It therefore made a great deal of sense for the federal government to protect its interests by devising means to utilize the skills that it had helped to develop. One of the main thrusts of this study was to evaluate the accomplishments of the internship program as a means of utilizing these skills.

An essential key to the success of this program would be the ability of the laboratories and interns involved to transfer technical information and knowledge from one to the other. Technology transfer has been defined by Gruber and Marquis as "the acceptance by a user of a practice common

elsewhere, or it may be a different application of a given technique designed originally for another use." [Ref. 6, p. 255-6]. An example of technology transfer is the widespread adaptation of many of the space program developments, such as teflon and sub-miniaturization of electronic components, to commercial applications.

If one accepts the principle that a considerable amount of the nation's research and development effort involves devising different uses of existing ideas, or further sophistication of known concepts, then it follows that an important facet of research and development is the capability to discover and transfer what has already been learned from one user to another.

Another important factor to be considered regarding the internship program is the capability of the program participants to develop and utilize innovative concepts. Barnett calls innovation "a new thought, behavior, or thing which is different from existing forms." [Ref. 2, p. 7]. It is certainly not difficult to conclude that the solution to such relatively recent areas of public concern such as pollution control and trash disposal, which had not been generally recognized as high priority national problems in previous generations, would require some innovative techniques.

Creighton, Jolly, and Denning [Ref. 4] have suggested that certain characteristics of some individuals would render them more effective in accomplishing the technology transfer mission than others. They went on to describe those individuals who exhibit the traits of gatekeeper (one who holds the strategic position in terms of the flow of knowledge from source to application [Ref. 7, p. 7-11]), innovator (early adapter of an innovation), early knower (one who consistently takes initiative on his own behalf to seek out scientific knowledge and derive useful learnings therefrom [Ref. 7, p. 7-41]), and opinion leader (the individual from whom others seek information and advice).

Individuals who display a high degree of conformance to this description have been termed by Creighton, Jolly and Denning as linkers, while those who show fairly little conformance were called stabilizers. They further hypothesized that there would be a relationship between the output efficiency utilization of research and the behavorial characteristics of the individuals in the user activities.

If linkers and stabilizers could be identified in the intern group, it would be of interest to analyze their performance characteristics, as viewed by their supervisors, in order to see if there were any significant differences and if one group or the other achieved superior performance results. Identification of such relationships, if they existed, could be of value to the laboratories and others who are concerned with acquiring services of people to accomplish research and development tasks.

It would be presumptuous however to assume that the interns themselves had complete control of their destinies, and it should be recognized that the nature of the laboratory itself would have some impact on the ability of the interns to function as either linkers or stabilizers. If, for example, a laboratory had established policies that would serve as barriers to the adaption of technological innovation, it would perhaps be difficult for a linker oriented individual to realize his full potential. Barriers, in this context, could include such things as failure of the laboratories to encourage and reward innovative suggestions, failure of supervisors to recognize and accept their subordinates' ability to develop useful new concepts, failure of the organization to maintain adequate channels of communication whereby employees can readily bring innovative suggestions to their supervisors' attention, and many others. It is also likely that some factors that may appear as barriers or demotivators to some individuals may not have the same detrimental effect on others.

With these thoughts in mind, the study was launched in quest of information that would prove relevant to the concepts discussed above.

IV. RESEARCH PROCEDURE

The objective of the research was to obtain information about the effectiveness of the Presidential Internships in Science and Engineering program. The method chosen to achieve this objective was a survey of the scientists and engineers who participated in the internship program and their immediate supervisors in the laboratories.

Since the program had been terminated, it was anticipated that some of the interns and supervisors would no longer be employed at the internship laboratories. Therefore, it was almost certain from the outset that it would be impossible to survey all interns or supervisors or even to obtain a truly random sampling of the original population.

With these limitations in mind the sample population was selected from the list of laboratories , Appendix A, that participated in the internship program. The sample was not random in that it was limited to those laboratories in the California area, laboratories with a large number of interns, and Department of Defense laboratories that could be contacted by Autovon telephone. These limitations were imposed as a method of minimizing the cost of the study and facilitating a quick response. This lack of a random sample violates a prime requirement of statistical significance implications to the total population. Therefore, the study team was able to apply the statistical measures only to the population of the sample.

A self-designating questionnaire was developed based upon a research of literature which examined the characteristics and qualities of the linker. The self-designation method was adopted as an effective but economic method of identifying the effectiveness of the program in that the individual's perceptions are what

actually affect his behavior [Ref. 9, p. 216].

The study team selected 15 of the 72 laboratories involved in the internship program that had employed 137 of the 557 interns. This was considered sufficient to adequately represent the total population. The questionnaires were returned as shown in Table 1.

TABLE 1

QUESTIONNAIRE DISTRIBUTION

Location	Number Mailed	Returned Intern	Returned Supervisor
Cold Regions Research and Research Laboratory	4	4	3
Brookhaven National Laboratory	15	9	9
Frankford Arsenal	3	2	1
Lawrence Berkeley Laboratory	9	4	0
National Aerospace Medical Research Laboratory	2	1	2
National Center for Earthquake Research	3	3	1
Naval Electronics Laboratory Center	8	5	6

TABLE 1 (CONT.)

Location	Number Mailed	Returned Intern	Returned Supervisor
Naval Missile Center Point Mugu	4	1	2
Naval Ordnance Laboratory	2	1	2
Naval Research Laboratory	44	30	0
Naval Ship Research and Development Center	6	4	4
Oak Ridge National Laboratory	12	8	0
Pacific Southwest Forest and Range Experiment Station	2	1	2
Picatinny Arsenal	10	6	9
Western Regional Research Laboratory	12	8	9
TOTALS	137	50	87

A selected number of interns and their supervisors were notified that they would be personally interviewed by a team member. This personal interview was utilized by the study team to examine unexpected responses and to identify results of the program that were not examined by the Census.

The questionnaire titled Census of Intern, Appendix B, consisted of twenty-nine multiple-choice questions directed

towards identifying the effectiveness of the program on the Interns and three open-ended questions dealing with biographical data. Each of the multiple-choice questions in the census will be grouped by objective and discussed to identify the characteristics upon which the question is based.

Questions one and two were directed toward the prime objective of the internship program. Question one states "After the one-year internship, the program helped me to obtain employment in the science or engineering fields." and question two was "The internship program increased my opportunities for employment commensurate with my abilities and experience." The assumption was made that the interns would be able to identify a change in their employment opportunities due to their participation in the internship program.

An attempt to define the interns' conception of their productivity was made in question three "It took me ____ months to become a productive member of the internship laboratory." Question four "I became a productive member of the laboratory faster than most other new members." was a subjective evaluation of each intern's feeling as to his relative productivity. It was hoped that these two questions combined with the respective questions on the Agency Representatives' Census would produce a more accurate measure of the interns actual effectiveness and productivity.

Aimed toward a direct identification of any increase in the technology transfer capability of the intern was question sixteen "The internship increased my capability to transfer new concepts or methods that represent technological advances to my next assignment." Creighton, Jolly, and Denning determined that "The scientist or engineer is able to perceptibly value the information only if he is aware of its existence; otherwise, the value is zero and the information will not be sought" [Ref. 4, p. 2].

McDonough argues that information has a value and will be sought only to the extent that its value exceeds the cost of obtaining it [Ref. 8, Ch. VI].

Questions six, seven, and eight were taken from the Professional Preference Census in the study by Creighton, Jolly, and Denning [Ref. 4]. These questions were selected because of their established high correlation factor (F value) in terms of Discrimination of Linkers vs Stabilizers [Ref. 4, p. 46].

Designed to measure the interns' innovativeness was question six "In the year of the internship, how many non-routine work-related projects were completed for which you supplied the original idea?" It was hypothesized that the number of non-routine, work-related projects would indicate a person's willingness to investigate new ideas.

Question seven "During the last month of your internship, indicate how many times you recommended a specific item of interest, e.g., journal article, research report, or a lead to either, to a colleague which dealt with a work-related topic." was related to the conclusion by Rogers and Shoemaker that "Earlier adapters have a higher degree of opinion leadership than later adapters" [Ref. 9, p. 189]. Blackwell found that "the first users of a product or service (innovators) are active in the word-of-mouth channel [Ref. 3, p. 15]. This research indicates that the one discrimination factor for an innovator should be the person's relative frequency of reception and transmission of ideas.

Question eight "Indicate the total number of journals, magazines, and newspapers which you regularly read:" was based on the following generalizations by Rogers and Shoemaker:

1. Earlier adapters have greater exposure to mass media communication channels than later adapters [Ref. 9, p. 189].
2. Earlier knowers of an innovation have more exposure

to mass media channels of communication than late knowers [Ref. 9, p. 108].

3. Opinion leaders have greater exposure to mass media than their followers [Ref. 9, p. 218].

Other research has also indicated that the innovator, when compared to the general population, was more likely to subscribe to five or more magazines [Ref. 5, p. 4].

Based on the hypothesis that any barriers would reduce the interns' innovativeness were question five "The routine formal paperwork requirements of the laboratory were quite detailed and often seemed very unproductive.", question twelve "How many innovative ideas or techniques did you recommend for implementation or investigation that were <u>not</u> accepted by the laboratory?" and question fourteen "The restrictions imposed on scientists and engineers in incorporating new innovations at this laboratory were:" (choices ranging from "minimal" to "excessive"). Closely associated with these questions is question thirteen "The <u>primary</u> reason for the laboratory not adapting all of the innovative ideas, concepts, or techniques suggested by interns was:" (alternatives ranging from "too much effort required to implement" to "ideas were not credible"). Barriers perceived by a person, whether real or not, are an actual hinderence however a barrier perceived by one person may or may not be a barrier to the innovativeness of another.

Based on the assumption that perceived rewards are an environmental factor and are likely to have a high correlation with the rate of technological innovation were question nine "The management of the internship laboratory encouraged its members to incorporate innovative ideas, concepts, and techniques." and question eleven "The internship laboratory gives individual recognition and/or financial rewards to its members who suggested new ideas that were used by the laboratory."

Three questions were designed to identify environmental

factors of the laboratories to information distribution. It was assumed that the method of information distribution and the method of information documentation have a high correlation with the rate of adoption of technological innovation. These questions included question twenty-two "I was very satisfied with the amount of information I got about what was going on at the laboratory.", question twenty-three "The way in which scientific information was shared at my laboratory was:" (choices ranging from "outstanding" to "entirely unsatisfactory.") and question twenty-seven "My supervisor had an open door policy which was real and useful in terms of providing an opportunity to discuss new ideas."

The hypothesis was that a highly stable laboratory would be more resistive to a new man with new ideas. Laboratories which have frequent changes in scientists and engineers would more readily accept these changes and therefore present fewer barriers to innovation led to the inclusion of question ten "My internship was spent in a department that had few changes in scientific or management personnel."

Questions twenty-four, twenty-five and twenty-six were inspired by the generalizations by Rogers and Shoemaker that:

1. Earlier adapters have greater exposure to interpersonal communication channels than later adapters [Ref. 9, p. 189].
2. Earlier knowers of an innovation have more exposure to interpersonal channels of communication than late knowers [Ref. 9, p. 108].

In addition, Allen determined that better performing groups rely more on internal sources of information than external sources [Ref. 1, p. 137-153]. This additional research indicated that the intern who utilizes the interpersonal communication channels will perform better. Mass media channels are relatively more important at the knowledge function, and interpersonal channels are relatively more

important at the persuasion function in the innovating decision process [Ref. 9, p. 255]. The items that evolved were question twenty-four "During the internship, I was able to relate in technical areas with ____ other member(s) of the laboratory.", question twenty-five "My most effective way of exchanging scientific or technical information in the laboratory was:" (choices ranging from "informal discussions on a one-to-one basis" to "formal meetings") and question twenty-six "Which of the following was your <u>major</u> source of scientific or technical information during your internship?" (alternatives from "other interns that I associated with" to "professional magazines, journals, technical reports, etc").

Seeking to identify the intern's relative professional position in the laboratory was question eighteen "My advancement pattern is better than my contemporaries." Closely related is question twenty-one "Compared to my co-workers of equal experience, my annual salary is:" (alternatives ranging from "far greater" to "far less"). These items were based on the study by Rogers that "Innovators and early adapters earn a higher gross income." [Ref. 10, p. 72].

Two questions, seventeen and nineteen, were an attempt to identify laboratory barriers to additional education. Question seventeen "Which of the following statements best describes your educational status?" (alternatives ranged from "received advanced degree before or during internship" to "have no immediate plans for working towards advanced degree") and question nineteen "Which of the following statements best describes the effect of the internship upon your desire to seek a Doctorate?" (choices were "encouraged me to seek a Doctorate" to "no influence-had already decided not to seek Doctorate") were also partially based upon the following proposition from Rogers and Shoemaker: "Earlier adapters have higher aspirations (for education, occupations, and so on) than later adopters." [Ref. 9, p.

188].

Aimed at identification of the laboratories' utilization of the intern and therefore to what extent the laboratories utilized the internship program to obtain specialized talent were question fifteen "I provided a highly specialized or hard-to-find talent that is not normally available to the laboratory." and question twenty-eight "My major value to the laboratory was:" (responses ranging from "the technical or scientific knowledge I brought with me that was new to the laboratory" to "my ability to carry out the technical and scientific instructions given to me by others").

Questions twenty-nine through thirty-two were utilized to obtain information on the background of the intern including previous and present positions, educational level, and a brief description of duties.

The questionnaire titled Census of Agency Representatives, as shown in Appendix C, consisted of Parts I and II. Part I consisted of eight questions directed towards establishing the professional atmosphere of the laboratories which affected the attitudes and performance of the interns, while Part II consisted of fourteen questions directed towards identifying the supervisors' observation of the interns' characteristics and productivity. Each question was associated with one or more questions in the Census of Intern questionnaire.

V. DATA

A. PRESENTATION OF DATA

In this section, the questions asked of interns and supervisors are matched against the specific objectives of the study listed in Chapter II. The absolute frequency for each response is given along with the percentage of total responses that the frequency figure represents. A brief summary precedes each question grouping.

OBJECTIVE 1. To determine if the program helped the interns to obtain employment in the science or engineering fields.

Seventy-eight percent of the interns strongly agreed or agreed that the internship helped them obtain employment in their fields and 76% strongly agreed or agreed that the internship increased their employment opportunity. Ninety-four percent of the supervisors strongly agreed or agreed that they would recommend the interns for employment. Only one supervisor disagreed.

The number of interns employed increased from 40 before the internship to 78 after. Three of the interns went back to school after the internship while six of them were unemployed. The total number of interns not holding jobs in their field decreased from 62 before the internship to nine after. Of those six interns who were unemployed after the internship, one had been previously under-employed, two had been employed in their field, and three had been in school.

FREQ. %

Intern question 1. After the one year internship, the program helped me to obtain

employment in the science or engineering fields.

a. strongly agree	39	44.8
b. agree	29	33.3
c. undecided	8	9.1
d. disagree	11	12.6
e. strongly disagree	0	0

Intern question 2. The internship program increased my opportunities for employment commensurate with my abilities and experience.

a. strongly agree	35	40.2
b. agree	31	35.6
c. undecided	9	10.3
d. disagree	9	10.3
e. strongly disagree	3	3.4

Supervisor Part II, question 1. After completion of the program, you did/will favorably recommend this intern for future employment.

a. strongly agree	31	62.0
b. agree	16	32.0
c. undecided	2	4.0
d. disagree	1	2.0

Intern question 29. Present position

a. employed in internship lab	54	62.1
b. employed in field	24	27.6
c. underemployed	0	0
d. unemployed	6	6.9
e. in school	3	3.4

Intern question 30. Previous position (before internship)

a. employed in field	26	29.9
b. underemployed	14	16.1
c. unemployed	2	2.3
d. in school	43	49.4
e. other	2	2.3

OBJECTIVE 2. To determine if the interns provided the laboratories with a specialized talent

Forty-eight percent of the interns and 46% of the supervisors strongly agreed or agreed that the interns provided the laboratory with a specialized talent. Forty-four percent of the interns and 48% of the supervisors felt that the interns professional knowledge was either far greater or greater than the interns' contemporaries. Only 7% of the interns and 10% of the supervisors felt it was less.

There was a moderate disagreement between the interns' and supervisors' responses regarding the interns' major value to the laboratory. The interns felt more strongly that their major value was the knowledge they brought with them to the laboratory or their ability to develop new concepts, with 59% of the interns selecting one of these responses. On the other hand, 58% of the supervisors indicated that the interns' ability to understand and use concepts already in use at the laboratory or to carry out instructions given by others was the interns' major value to the laboratory.

Intern question 15. I provided a highly specialized or hard-to-find talent that is not normally available to the laboratory.	FREQ.	%
a. strongly agree	15	17.2
b. agree	27	31.0
c. undecided	20	23.0
d. disagree	23	26.4
e. strongly disagree	2	2.3

Supervisor Part II, question 9. This intern provided a highly specialized or hard-to-find talent that is not normally available to your laboratory.

a. strongly agree	9	18.0
b. agree	19	38.0
c. undecided	4	8.0
d. disagree	13	26.0
e. strongly disagree	5	10.0

Intern question 20. How do you compare yourself in relation to your co-workers in your area of professional knowledge?. My knowledge is:

a. far greater	8	9.2
b. greater	30	34.5
c. about the same	43	49.4
d. less	6	6.9

Supervisor Part II, question 12. How do you compare this intern's professional knowledge with that of his co-workers' who have equivalent positions in your agency? The intern's knowledge is:

a. far greater	7	14.0
b. somewhat greater	17	34.0
c. the same	21	42.0
d. somewaht less	5	10.0

Intern question 28. My major value to the laboratory was:

a. the technical or scientific knowledge that I brought with me that was new to the laboratory	18	20.7
b. my background of scientific knowledge		

that enabled me to develop new concepts	33	37.9
c. my ability to learn, understand, and use concepts that were being used at the laboratory	26	29.9
d. my ability to carry out the technical and scientific instructions given to me by others.	6	6.9
e. other	4	4.6

Supervisor Part II, question 14. This intern's major contributation to the laboratory was:		
a. the technical or scientific knowledge that he brought with him that was new to the labcratory	8	16.0
b. his background of scientific knowledge that enabled him to develop new concepts	13	26.0
c. his ability to learn, understand and use concepts that were being used at the laboratory	20	40.0
d. his ability to carry out technical and scientific instructions given by others	9	18.0

<u>OBJECTIVE 3</u>. To determine how long it took the interns to become productive members of their laboratories.

Sixty-three percent of the interns and 50% of the supervisors felt that the interns had become productive within two months. Only 2% of the interns and supervisors felt that it took the interns longer than six months to become productive.

Thirty-nine percent of the interns and 68% of the supervisors thought that the interns had become productive faster than most other new members.

	FREQ.	%
Intern question 3. It took me ____ months to become a productive member of the internship laboratory		
a. 0-2	55	63.2
b. 3-4	24	27.6
c. 5-6	6	6.9
d. 7-12	2	2.3

Supervisor Part II, question 2. How long did it take for the intern to become a productive member of the laboratory?

a. 0-2 months	25	50.0
b. 3-4 months	15	30.0
c. 5-6 months	3	6.0
d. 7-12 months	6	12.0
e. not sure	1	2.0

Intern question 4. I became a productive member of the laboratory faster than most other new members.

a. strongly agree	15	17.2
b. agree	19	21.8
c. undecided	41	47.1
d. disagree	12	13.8

Supervisor Part II, question 4. This intern became a productive member of the laboratory faster than most other new members

a. strongly agree	10	20.0
b. agree	24	48.0
c. undecided	8	16.0
d. disagree	8	16.0

<u>OBJECTIVE</u> <u>4</u>. To determine what effect the internship had on influencing the interns to seek a doctorate.

Fifty-six percent of the supervisors strongly agreed or agreed that their laboratory's policy was to encourage interns to seek advanced degrees, while 10% of the supervisors disagreed with this statement.

Of the 45 interns who did not have a doctorate prior to the internship, 31 indicated that the internship had no influence upon their desire to seek a doctorate and that they had already decided one way or the other. Eight interns said the program encouraged them to seek a doctorate and four said the internship discouraged them.

Intern question 17 was apparently interpreted in various ways by the interns due to the fact that the term "advanced degree" was not clearly defined. As a result, this question did not yield any meaningful information.

	FREQ.	%
Supervisor Part I, question 4. This laboratory's policy was to encourage those interns who had not yet earned advanced degrees to do so.		
a. strongly agree	4	8.0
b. agree	24	48.0
c. undecided	17	34.0
d. disagree	5	10.0

Intern question 31. Educational level prior to internship.		
a. BS	1	1.1
b. MS	44	50.6
c. PHD	42	48.3

Intern question 19. Which of the following statements best describes the effect of the internship upon your desire to seek a doctorate?

a. encouraged me to seek a doctorate	8	9.2
b. discouraged me from seeking a doctorate	6	6.9
c. no influence-had already decided to seek a dcctorate	23	26.4
d. no influence-had already decided not to seek a doctorate	13	14.9
e. other	4	4.6
f. already had	33	37.9

Intern question 17. Which of the following best describes your educational status?

a. received advanced degree before or during internship	79	90,8
b, received advanced degree after internship	1	1.1
c. currently working towards advanced degree	6	6.9
d. intend to begin working toward advanced degree in near future	1	1.1

<u>OBJECTIVE 5</u>. To determine if the interns' salaries and advancement patterns were equivalent to those of their contemporaries.

The interns' and supervisors' responses regarding the interns' advancement pattern were quite similar. Twenty-nine percent of the interns and 34% of the supervisors agreed or strongly agreed that the interns' advancement pattern was better than their contemporaries, while 25% of the interns and 26% of the supervisors disagreed or strongly disagreed with this supposition. The most frequent answer chosen by both groups was "undecided."

Sixty-three percent of the interns felt that their salaries were either higher or much higher than their contemporaries, while only 6% felt they were lower.

	FREQ.	%
Intern question 18. My advancement pattern is better than my contemporaries.		
a. strongly agree	7	8 0
b. agree	18	20.7
c. undecided	40	46.0
d. disagree	20	23.0
e. strongly disagree	2	2.3
Supervisor Part II, question 11. This intern's advancement pattern is better than that of his co-workers'.		
a. strongly agree	5	10.0
b. agree	12	24.0
c. undecided	20	40.0
d. disagree	11	22.0
e. strongly disagree	2	4.0
Intern question 21. Compared to my co-workers of equal experience, my annual salary is:		
a. much higher	7	8.0
b. higher	48	55.2
c. about the same	27	31.0
d. lower	5	5.7

OBJECTIVE 6. To determine if the internship increased the interns' capability for technology transfer.

Seventy-eight percent of the interns and 80% of the supervisors agreed or strongly agreed that the internship had improved the interns' technical transfer capability, while 10% of the interns and only 2% of the supervisors disagreed or strongly disagreed with this statement.

		FREQ.	%
Intern question 16. The internship increased my capability to transfer new concepts or methods that represent technological advances to my next assignment.			
	a. strongly agree	27	31.0
	b. agree	41	47.1
	c. undecided	10	11.5
	d. disagree	7	8.0
	e. strongly disagree	2	2.3
Supervisor Part II, question 10. The internship program increased this intern's capability to transfer new concepts or methods that represent technological advances to his next assignment.			
	a. strongly agree	16	32.0
	b. agree	24	48.0
	c. undecided	9	18.0
	d. disagree	1	2.0

OBJECTIVE 7. To determine how technical information was transferred between the interns and other members of the laboratory and to examine how information was obtained by laboratory members.

Fifty-one percent of the interns felt that the way in which the laboratory shared scientific information was either outstanding or completely satisfactory, while only one intern indicated that he felt the laboratory was completely unsatisfactory in this regard. Sixty-seven percent of the interns agreed or strongly agreed that they were satisfied with the amount of information they got about what was going on at the laboratory and 60% of the supervisors either agreed or strongly agreed that the top management of the laboratory was effective in keeping the

scientists and engineers informed about what was going on. One supervisor strongly disagreed that his laboratory was effective in sharing information. The negative responses to questions regarding the distribution of information in the laboratories were generally spread among several laboratories with only one receiving predominantly negative responses.

Ninety-two percent of the interns indicated that they were able to relate in technical areas with two or more other members of their laboratories, while only one intern could relate with no one. Twenty-five percent of the interns thought they could relate with more than six other laboratory members and several of them indicated that they could relate with anyone in the laboratory.

By far the response most frequently chosen as the most effective way of exchanging technical information in the laboratory was "informal discussions on a one-to-one basis" with 83% of the interns and 56% of the supervisors in agreement. Only 3% of both the intern and supervisor groups indicated that written memos or reports, or formal meetings were most effective.

Fifty-nine percent of the interns indicated that other scientists and engineers from their laboratories were their major source of scientific or technical information and 48% of the supervisors felt that discussions among this group was the major method of obtaining information. Twenty-four percent of the supervisors thought that discussions between laboratory members and scientists, engineers and educators from other activities was the major way of obtaining scientific information, but only 6% of the interns felt that this was their major source of information.

Most of the supervisors (64%) felt that if the intern assigned to him had an idea he thought would be useful to the laboratory, he would be most likely to discuss it with his supervisor and only two supervisors said the intern would write a report or implement the idea on his own

authority.

	FREQ.	%
Intern question 23. The way in which scientific information was shared at my laboratory was:		
a. outstanding	16	18.4
b. completely satisfactory	28	32.2
c. adequate	29	33.3
d. inadequate	13	14.9
e. entirely unsatisfactory	1	1.1
Supervisor Part I, question 5. Top management was effective in keeping the scientists and engineers posted about what was going on at the laboratory.		
a. strongly agree	5	10.0
b. agree	25	50.0
c. undecided	11	22.0
d. disagree	8	16.0
e. strongly disagree	1	2.0
Intern question 22. I was very satisfied with the amount of information I got about what was going on at the laboratory.		
a. strongly agree	21	24.1
b. agree	37	42.5
c. undecided	8	9.2
d. disagree	17	19.5
e. strongly disagree	4	4.6
Intern question 24. During the internship, I was able to relate in technical areas with ____ other member(s) of the laboratory.		
a. 0	1	1.1
b. 1	2	2.3

c. 2-3	25	28.7
d. 4-6	33	37.9
e. >6	22	25.3
f. other	4	4.6

Intern question 25. My most effective way of exchanging scientific or technical information in the laboratory was:

a. informal discussions on a one-to-one basis	72	82.8
b. informal group meetings	12	13.8
c. written memos or reports	2	2.3
d. formal meetings	1	1.1

Supervisor Part I, question 7. I have observed that the most effective way that scientific information and technology were exchanged in this laboratory during the internship period was:

a. informal discussions on a one-to-one basis	28	56.0
b. informal group meetings	15	30.0
c. written memos or formal reports	5	10.0
d. formal meetings	1	2.0
e. other (all of the above)	1	2.0

Intern question 26. Which of the following was your major source of scientific or technical information during your internship?

a. other interns that I associated with	3	3.4
b. scientists and engineers from my laboratory	51	58.6
c. scientists and engineers from other activities	5	5.7
d. professional magazines, journals, technical reports, etc.	25	28.7

e. other	3	3.4

Supervisor Part I, question 8. The major method of obtaining scientific information or technology at this laboratory is:

a. discussions among scientists and engineers assigned to the laboratory	24	48.0
b. discussions between laboratory members and scientists, engineers, and educators from other activities	12	24.0
c. written reports originated and distributed within the laboratory	2	4.0
d. written information from outside sources	9	18.0
e. other	3	6.0

Supervisor Part II, question 13. If this intern had a new idea he thought would be a useful concept to the laboratory, he would be most likely to:

a. discuss it with his associates	14	28.0
b. discuss it with his superior	32	64.0
c. write a memo or report	1	2.0
d. implement it on his own authority	1	2.0
e. other	2	4.0

<u>OBJECTIVE</u> <u>8</u>. To determine if there were identifiable barriers to the transfer of technology between the interns and other members of the laboratory.

The majority of the interns (73%) and supervisors (60%) either disagreed or strongly disagreed that the paperwork requirements of their laboratories were often unproductive.

Seventy-two percent of the interns and 88% of the supervisors either agreed or strongly agreed that the laboratory management encouraged its members to incorporate

innovative ideas. Of twelve interns who disagreed that the laboratory encouraged innovation, nine were assigned to stable departments that had few changes in scientific personnel. Remarks made by interns during the personal interviews showed some belief that older, well-stabilized departments are not as likely to encourage innovation as newer ones.

Fifty-five percent of the interns and 88% of the supervisors strongly agreed or agreed that the laboratory gave individual recognition or financial rewards to members suggesting new ideas. A much larger percentage of interns than supervisors (25% vs. 6%) disagreed or strongly disagreed with this statement.

Most of the supervisor (70%) either agreed or strongly agreed that most of the innovative ideas or techniques suggested by the interns were accepted by the laboratory. Oddly, the interns who worked for the two supervisors who strongly disagreed that the laboratory accepted innovative ideas both said that all of their suggestions were accepted.

There was no general concensus among either the interns or the supervisor as to the primary reason that the laboratory did not adapt all of their innovative suggestions. The answer most frequently given was that they did not meet the laboratory's needs, with 24% of the interns and 30% of the supervisors choosing this answer.

Sixty-one percent of the interns and 72% of the supervisors felt that the restrictions imposed on scientists and engineers in incorporating new ideas were minimal or very reasonable. Only one supervisor felt the restrictions in his laboratory were excessive.

most of the interns (86%) agreed or strongly agreed that their supervisors had an open door policy. There was only a moderate indication that those six interns who disagreed or strongly disagreed with this statement felt that their laboratories were restrictive in incorporating new ideas, did not encourage innovation, or did not give individual

recognition.

Intern question 5. The routine formal paperwork requirements of the laboratory were quite detailed and often seemed very unproductive

	FREQ.	%
a. strongly agree	4	4.6
b. agree	8	9.2
c. undecided	12	13.8
d. disagree	50	57.5
e. strongly disagree	13	14.9

Supervisor Part I, question 6. The routine formal paperwork requirements at this laboratory are quite detailed and often seem very unproductive.

a. strongly agree	3	6.0
b. agree	11	22.0
c. undecided	6	12.0
d. disagree	29	58.0
e. strongly disagree	1	2.0

Intern question 9. The management of the internship laboratory encouraged its members to incorporate innovative ideas, concepts, and techniques.

a. strongly agree	25	28.7
b. agree	38	43.7
c. undecided	12	13.8
d. disagree	10	11.5
e. strongly disagree	2	2.3

Supervisor Part I, question 1. The management of this laboratory encourages its members to incorporate innovative ideas,

concepts, and techniques.

a. strongly agree	26	52.0
b. agree	18	36.0
c. undecided	4	8.0
d. disagree	1	2.0
e. strongly disagree	1	2.0

Intern question 10. My internship was spent in a department that had few changes in scientific or management personnel

a. strongly agree	27	31.0
b. agree	36	41.4
c. undecided	7	8.0
d. disagree	14	16.1
e. strongly disagree	3	3.4

Supervisor Part II, question 3. This intern was assigned to a department that had few changes in personnel.

a. strongly agree	18	36.0
b. agree	24	48.0
c. undecided	2	4.0
d. disagree	5	10.0
e. strongly disagree	1	2.0

Intern question 11. The internship laboratory gives individual recognition and/or financial rewards to its members who suggested new ideas that were used by the laboratory.

a. strongly agree	17	19.5
b. agree	31	35.6
c. undecided	17	19.5
d. disagree	21	24.1
e. strongly disagree	1	1.1

Supervisor Part I, question 2. The

management of this laboratory gives individual recognition and/or financial rewards to members who suggest new ideas that are adapted by the laboratory.

a. strongly agree	16	32.0
b. agree	24	48.0
c. undecided	7	14.0
d. disagree	2	4.0
e. strongly disagree	1	2.0

Intern question 12. How many innovative ideas or techniques did you recommend for implementation or investigation that were not accepted by the laboratory?

a. all were accepted	30	34.5
b. 1-2	40	46.0
c. 3-5	8	9.2
d. 6-10	1	1.1
e. not sure	8	9.2

Supervisor Part II, question 7. Most of the innovative ideas or techniques that were suggested by this intern were accepted by the laboratory.

a. strongly agree	6	12.0
b. agree	29	58.0
c. undecided	9	18.0
d. disagree	4	8.0
e. strongly disagree	2	4.0

Intern question 13. The primary reason for the laboratory not adapting all of the innovative ideas, concepts, or techniques suggested by the interns was:

a. too much effort required to implement	17	19.5
b. too much risk involved	2	2.3

c. they did not meet the laboratory's needs	21	24.1
d. ideas suggested by interns were not considered credible	5	5.7
e. other	36	41.4
f. few rejected	6	6.9

Supervisor Part II, question 8. The primary reason for this laboratory not adapting all of the innovative ideas, concepts or techniques suggested by this intern was:

a. too much effort required to implement	7	14.0
b. too much risk involved	1	2.0
c. they didn't meet the laboratory's needs	15	30.0
d. they were not practical	3	6.0
e. other	21	42.0
f. few rejected	3	6.0

Intern question 14. The restrictions imposed on scientists and engineers in incorporating new innovations at this laboratory were:

a. minimal	26	29.9
b. very reasonable	27	31.0
c. acceptable	27	31.0
d. restrictive	7	8.0

Supervisor Part I, question 3. The restrictions imposed by top management on scientists and engineers in incorporating new innovations are:

a. minimal	14	28.0
b. very reasonable	21	42.0
c. acceptable	9	18.0
d. restrictive	5	10.0
e. excessive	1	2.0

Intern question 27. My supervisor had an open door policy which was real and useful in terms of providing an opportunity to discuss new ideas.

a. strongly agree	45	51.7
b. agree	30	34.5
c. undecided	6	6.9
d. disagree	2	2.3
e. strongly disagree	4	4.6

OBJECTIVE 9. To determine some of the characteristics of the interns involved. Of particular interest are those characteristics associated with the linker and stabilizer concepts described by Creighton, Jolly, and Denning [Ref. 4].

Fifty-two percent of the interns and 62% of the supervisors indicated that the interns had supplied one or two original ideas for projects. Six percent of the interns and one percent of the supervisors said the interns had provided five or more original ideas.

Thirty-seven percent of the interns said they had recommended three or four articles to their colleagues, 15% had not recommended any, and only one had recommended six or more.

Fifty-eight percent of the interns indicated that they regularly read up to six journals, magazines, or newspapers. Forty-two percent read seven or more. None of the interns indicated that they didn't regularly read at least one periodical.

Three times as many supervisors disagreed or strongly disagreed that they went to the intern as a frequent source of information as those who agreed or strongly agreed. The largest single grouping however was the 44% who were undecided.

Seventy percent of the supervisors agreed or strongly agreed that most of the ideas suggested by the interns were accepted by the laboratory while only 12% disagreed or strongly disagreed.

	FREQ.	%
Intern question 6. In the year of the internship, how many non-routine, work-related projects were completed for which you supplied the original idea?		
a. 0	14	16.1
b. 1-2	45	51.7
c. 3-4	13	14.9
d. 5-6	3	3.4
e. >6	3	3.4
f. other	9	10.3
Supervisor Part II, question 5. During his internship, how many non-routine, work-related projects have been completed for which this intern supplied the original idea?		
a. 0	7	14.0
b. 1-2	31	62.0
c. 3-4	8	16.0
d. 5-6	1	2.0
e. not sure	3	6.0
Intern question 7. During the last month of your internship, indicate how many times you recommended a specific item of interest, e.g., journal article, research report, or a lead to either, to a colleague which dealt with a work related topic.		
a. 0	13	14.9
b. 1-2	23	26.4
c. 3-4	32	36.8

d. 5-6	11	12.6
e. >6	1	1.1
f. not sure	7	8.0

Intern question 8. Indicate the number of journals, magazines, and newspapers which you regularly read:

a. 1-2	10	11.5
b. 3-4	20	23.0
c. 5-6	20	23.0
d. 7-8	22	25.3
e. 9-12	10	11.5
f. 13-20	5	5.7

Supervisor Part II, question 6. I went more frequently to this intern than any other one of his co-workers for work-related information and/or advice which was not a function of their formal positions.

a. strongly agree	2	4.0
b. agree	5	10.0
c. undecided	22	44.0
d. disagree	18	36.0
e. strongly disagree	o	6.0

<u>OBJECTIVE</u> <u>10</u>. To determine if specific intern characteristics were related to their performance at the labcratory.

It was speculated that those interns having the strongest linker traits would have different performance characteristics than those with stronger stabilizer traits. In an effort to prove or disprove this supposition, intern questions 6, 7, and 8, which were designed to measure linker-stabilizer traits, were cross-tabulated with the supervisor, part II questions 5, 6, 7, 9, 10, 12, and 13,

which should give an indication of the interns' performance. For this analysis, only those questionnaires that provided match-ups between interns and their individual supervisors were used. This resulted in a substantial reduction of the sample size to thirty-one intern-supervisor match-ups. the results of this cross-tabulation showed no apparent relationship between performance characteristics and linker-stabilizer traits.

Next, an analysis was performed by combining the scores on intern questions 6, 7, and 8 and ranking the interns according to total scores obtained. The upper group was designated as potential linkers, the lower group as potential stabilizers, and the indiscriminate middle group as neither potential linkers or stabilizers. The linker-stabilizer groups were then cross-tabulated against the same supervisor questions listed in the preceding paragraph. Again, no apparent relationship existed between the performance characteristics and linker-stabilizer traits.

Various other combinations of cross-tabulations between intern questions designed to measure linker-stabilizer traits and supervisor questions that indicated intern performance all failed to produce any significant relationships between the two.

B. ANALYSIS

The responses from the interns' and supervisors' questionnaires were recorded on computer cards and analyzed by utilizing a set of computer programs called the Statistical Package for the Social Sciences (SPSS). These programs provided the means to obtain a timely overview of the data received.

The SPSS program was used to provide cross-tabulations, to compute values of chi-square [Appendix D(2)], and to compute Pearson Product-Moment Correlation Coefficients

[Appendix D(3)]. These three methods of comparing responses to various combinations of intern-supervisor questions were used to identify relationships among the question responses.

The cross-tabulations simply provided contingency tables which, although not particularly useful by themselves, were the basis for determination of chi-square significance levels. The chi-square significance levels were in turn used to measure the degree of inter-dependence between the two questions being compared.

Very few of the comparisons produced a significance figure of 5% or less, which was the risk level considered appropriate for this study. This result indicated that the response patterns for the two groups, interns and supervisors, were not inter-dependent in general. That is, the two groups tended to respond differently even when asked identical questions.

The major areas in which their answers appeared to be inter-dependent were in regard to the extent of laboratory restrictions, the effect of the internships upon the interns' technical transfer capability, and the propensity of the laboratory to encourage innovation.

The number of chi-square comparisons made was limited to those match-ups that appeared to be particularly pertinent to the study and the possibilities were by no means exhausted.

Pearson's correlations were computed for all possible combinations of intern-supervisor questions in order to ascertain if there were any linear relationships between the answers given by the interns and their supervisors. Those combinations that resulted in a correlation significance factor of 0.05 or less were examined in greater detail in an effort to determine which specific factors were related. Some of the more significant relationships were summarized as follows:

1. The interns were more likely to feel that the program helped them to obtain employment when their laboratories had

relatively few restrictions.

2. If the interns thought the program increased their employment opportunity, the laboratory was likely to have encouraged and rewarded innovation, and to have exercised few restrictions.

3. Where the interns felt that the laboratory encouraged innovation, laboratory restrictions were apt to be minimal and most of the interns' ideas were accepted by their supervisors.

4. Interns who thought the laboratory rewarded innovation were judged by their supervisors to become productive faster than others.

5. The interns who were assigned to the more stable departments felt they had a better advancement pattern than their contemporaries.

6. The interns who thought their supervisors had an open door policy took less time to become productive, had most of their ideas accepted by the laboratory, provided the laboratory with a specialized talent, had a better advancement pattern than their contemporaries, and were considered by their supervisors to have a greater degree of professional knowledge than their contemporaries.

VI. CONCLUSIONS

From the outset, it was apparent that the large majority of interns were helped by the internship program. Over half of the interns remained with the laboratory upon completion of the internship and most of the others were either adequately employed in their field of expertise or had returned to school. The internship program also gave the laboratories a unique opportunity to evaluate the performance of the interns inexpensively and with a minimum of contractural obligation. Personal interviews with supervisors and personnel managers resulted in a clear-cut consensus that they felt the program had been really beneficial to them. In most cases, the supervisors would have gladly retained the interns assigned to them under this program if funding and personnel ceilings had permitted.

Although the interns appeared to have provided the laboratories with technical expertise they could not have otherwise afforded, there seemed to be a tendency for the supervisors to view the interns' role more as trainees or helpers than as research specialists. Personal interviews with some of the supervisors revealed a lack of complete knowledge of the objectives and ground rules of the program. In one case, for instance, the supervisor was not notified in advance that an intern was going to be assigned to him and was not advised of the purpose of the assignment. While it is not known how widespread this lack of program knowledge was, there is some evidence that better communication throughout the laboratories at the beginning of the program could have resulted in better utilization of the interns' skills.

The ability to communicate and utilize concepts that are considered technological advances has been discussed as a primary characteristic required of the program participants.

If this is so, then the technical transfer capabilities possessed by the interns should have been a considerable asset to the laboratories. A large majority of the interns supplied at least one original idea for non-rcutine work-related projects that were completed by the laboratory, with many of them providing several such ideas. Additionally, it was apparent that both the interns and their supervisors thought that the interns technology transfer capability was improved during the internship period and this increased ability should prove even more useful tc them in future assignments.

An element that should be of considerable importance to laboratory managers is the means by which technolcgical information is exchanged among their scientific work forces. In this case, one-to-one discussions between laboratory personnel were by far considered the most effective means of exchanging such information. Small informal group discussions nearly completed the number of methods that laboratory personnel felt were effective devices for communicating technical information. Written reports and formal meetings were not considered by many to be the best means of accomplishing this task. These conclusions result in a requirement for laboratory managers to consider ways that technological information can be effectively distributed to more than one other person or to large numbers of personnel. Perhaps one answer lies in the identification and more deliberate, planned use of his linker-oriented personnel.

Although there is no set criteria for classifying individuals as linkers or stabilizers, it was possible during the study to identify interns within the sample group that possessed relatively high degrees of linker or stabilizer tendencies. From the previous conclusion, one might surmise that the laboratories would have used these two groupings of interns in different ways in order tc make best use of their respective talents in accomplishing the

laboratories' research and development mission. There is however little evidence that the laboratories formally recognized the characteristics described by the linker-stabilizer concept and there did not appear to be any significant differences in the laboratories' utilization of these two groups.

The supervisors' evaluations of the interns' performance also did not show any significant differences between the linker and stabilizer oriented groups. One assumption that perhaps falls too easily to mind when considering the linker-stabilizer characteristics is that one group is likely to be superior to the other in some of their performance or output traits. The results of this study do not support that assumption however and one might speculate on the possible reasons as follows:

1. the short-term, one-year performance period may not have been sufficient to allow the discriminating traits to emerge, be recognized, and be utilized.

2. performance is not evaluated on some unique, absolute scale, but is more an interpretation of the employees' performance as seen through their supervisors' eyes. i.e., a supervisor with strong linker traits might value the same traits in his employess more highly than a supervisor having different traits.

3. the study may not have adequately discriminated between linker and stabilizer oriented interns.

4. the interns may not be a typical group in terms of linker-stabilizer characteristics.

5. the elapsed time since the termination of the internship program and the study (ranging from one to two-and-a-half years) may have tended to obscure the supervisors' recollection of the interns' performance.

The possible existence of one or more of the above factors, or some other unknown influencing factor, was not included in the scope of this study and therefore was not investigated.

In general, there did not appear to be an excessive number of barriers in the laboratories that would tend to discourage employees from submitting innovative suggestions. There was some indication however that individual laboratories that had specific types of barriers, such as lack of an open-door policy by supervisors, were less likely to receive and use innovative suggestions from the interns. This trend was not strong enough to be considered conclusive.

VII. LIMITATIONS OF THE STUDY

The time factor made itself apparent very early in the study. The amount of time required to establish initial contact with the laboratories and to obtain names and mailing addresses of the interns assigned to the individual laboratories limited the study in that it resulted in a shorter amount of time being allocated for responses to be returned to the study team and for analysis of results.

The sample size was smaller than desired. Although questionnaires were mailed out to 137 interns and their supervisors, only 31 matched intern-supervisor responses were received. Fewer supervisor responses were received than those from interns. This may have been due to the fact that some of the original supervisors had moved on to other activities, that laboratory contacts failed to distribute the supervisor questionnaires to the appropriate people, that supervisors did not feel they had adequate recall to properly provide answers relating to activities that occured over a year ago, or simply that they did not get around to responding. Whatever the reason, it would have been beneficial to the study if more match-ups had been obtained.

A number of areas not addressed by the questionnaire came up during the course of the study and during the personal interviews. Some of these items, now thought to be related to the interests of the study, are included in the next section.

VIII. SUGGESTIONS FOR FURTHER RESEARCH

During the course of this study, several areas of possible interest regarding the internship program came to light that were not specifically addressed. These interest areas include:

1. What specific contributions did the interns make while working at the host activities?

2. Did the internship leave the interns with a favcrable attitude toward Federal Research and Development faciliies?

3. Did the interns utilize any of the knowledge or experience gained at the laboratories in their subsequent job assignments?

4. Is personnel exchange the most effective means of accomplishing technology transfer in Federal laboratories?

5. Could the accomplishments of the internship program have been achieved more effectively in other ways?

It is strongly recommended that any future studies in this area be accomplished under the sponsorship of the National Science Foundation, utilizing the entire population of 557 interns. A complete set of intern personnel records should currently be available through the Foundation's files.

Creighton, Jolly, and Denning [Ref. 4] have defined the linker-stabilizer concept and have proposed ways of discriminating between individuals possessing various traits associated with these two groupings. They also hypothesized that "there is a relationship between output efficiency utilization of research and development and the behavioral characteristics of the individuals in the user organization."

Since the internship study did not adequately treat this hypothesis, some interesting questions are raised in regard to evaluation methods and criteria for measuring performance

as a function of linker-stabilizer traits.

One suggested approach to this problem would be to administer a form of the linker-stabilizer questionnaire to a specific group while at the same time asking for performance evaluations in specified areas from individual supervisors of each of the study group members. Another less sophisticated approach might be to track the performance of a group already tested.

APPENDIX A

Distribution of Presidential Internships by State

ALABAMA

U.S. Army Missile Command Laboratory	3

CALIFORNIA

Aerospace Corporation	2
Ames Research Laboratory	7
Crocket Research Laboratory	4
Lawrence Berkeley Laboratory	30
Lawrence Livermore Laboratory	8
National Center for Earthquake Research	3
Naval Electronics Laboratory Center	8
Naval Missile Center	2
Naval Personnel and Training Research Laboratory	5
Pacific Missile Center	2
Pacific Southwest Forest and Range Experimental Station	2
Southwest Fisheries Center	1
Stanford Linear Accelarator Center	8
Western Regional Research Laboratory	14

COLORADO

Engineering and Research Center	1
Environmental Research Laboratory	22
Institute of Telecommunication Science	5
National Center for Atmospheric Research	7
Rocky Mountain Forest and Range Experimental Station	14

CONNECTICUT

Naval Submarine Medical Research Laboratory	2

WASHINGTON D.C.

Federal Highway Administration	9
Harry Diamond Laboratory	3
National Bureau of Standards	39
National Technical Information Service	1
Naval Personnel Research and Development Laboratory	5
Naval Research Laboratory	44
Smithsonian Institution	18

FLORIDA

Naval Aerospace Medical Research Laboratory	3
Argonne National Laboratory	54
Construction Engineering Research Laboratory	3
U.S. Army Weapons Command	4

INDIANA

Radiation Laboratory	2

IOWA

Ames Laboratory	11

MARYLAND

Agriculture Research Service	20
Applied Physics Laboratory	2
Cyclotron Laboratory	1
Environmental Data Service	3
Human Nutrition Research	3

National Ocean Survey	2
National Weather Survey	4
Naval Medical Research Institute	5
Naval Ordnance Laboratory	3
Naval Ship Research and Development Center	6
U.S. Army Warfare Laboratory	2

MICHIGAN

Tank Automotive Command	2

MINNESOTA

National Water Quality Laboratory	2

NEW HAMPSHIRE

Cold Region Research and Engineering Laboratory	4

NEW JERSEY

Electronics Communications	12
Picatinny Arsenal	13

NEW MEXICO

Los Alamos Science Laboratory	26

NEW YORK

Brookhaven National Laboratory	23

NORTH CAROLINA

Public Health Service	2

OHIO

Avionics Research Laboratory	1
Mound Laboratory	2

OREGON

Pacific Northwest Forest and Range Experimental Station	6

PENNSYLVANIA

Bartol Research Foundation	2
Frankford Arsenal	5

TENNESSEE

Oak Ridge Association	2
Oak Ridge National Laboratory	22

UTAH

Intermountain Forest and Range Experimental Station	2

VIRGINIA

Center for Naval Analysis	3
Naval Weapons Laboratory	5
U.S. Army Research and Development	2
Human Resources Research	1

WASHINGTON

Applied Physics Laboratory	2
North Pacific Fisheries Research Center	13
Pacific Fisheries Products Research	2
Pacific Northwest Laboratory	1
TOTAL	557

APPENDIX B

Letter to Intern

Naval Postgraduate School
Monterey, California 93940
March 22, 1974

Dear

At the request of the National Science Foundation, a study team has been formed at the Naval Postgraduate School to conduct a follow-up study of the Presidential Internships in Science and Engineering Program, in which you were an active participant.

The primary source of data for the study will be questionnaires completed by the individual interns and representatives from the participating laboratories. A copy of the questionnaire has been enclosed which you are requested to complete at your earliest convenience and return to the study team via the return-addressed envelope.

Please be assured that your responses will be held in the strictest confidence and under no circumstances will the study report make references to specific individuals or laboratories.

Your support and cooperation in carrying out this study will be greatly appreciated by the team members. If you have any questions or comments regarding the study, please don't hesitate to contact us.

Sincerly,
Dr. J.W. Creighton
Code 55CFC
Phone (408)646-2048

PRESIDENTIAL INTERNSHIPS IN SCIENCE AND ENGINEERING
CENSUS OF INTERN

INTERN'S NAME____

Each question requires that you circle one answer only. Please answer all of the questions in the census.

These questions apply only to the internship and not to any subsequent position or periods.

1. After the one year internship, the program helped me to obtain employment in the science or engineering fields.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

2. The Internship Program increased my opportunities for employment commensurate with my abilities and experience.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

3. It took me ____ months to become a productive member of the internship laboratory.

a. 0-2
b. 3-4
c. 5-6
d. 7-12
e. other - specify____

4. I became a productive member of the laboratory faster than most other new members.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

5. The routine formal paper work requirements of the laboratory were quite detailed and often seemed very unproductive.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

6. In the year of the internship, how many non-routine, work-related projects were completed for which you supplied the original idea?

a. 0

b. 1-2

c. 3-4

d. 5-6

e. other - specify____

7. During the last month of your internship, indicate how many times you recommended a specific item of interest, e.g., journal article, research report, or a lead to either, to a colleague which dealt with a work-related topic.

a. 0

b. 1-2

c. 3-4

d. 5-6

e. other - specify____

8. Indicate the total number of journals, magazines, and newspapers which you regularly read:

a. 1-2
b. 3-4
c. 5-6
d. 7-8
e. other - specify________________________________

9. The management of the internship laboratory encouraged its members to incorporate innovative ideas, concepts, and techniques.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

10. My internship was spent in a department that had few changes in scientific or management personnel.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

11. The internship laboratory gives individual recognition and/or financial rewards to its members who suggested new ideas that were used by the laboratory.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

12. How many innovative ideas or techniques did you recommend for implementation or investigation that were <u>not</u> accepted by the laboratory?

a. all were accepted

b. 1-2

c. 3-5

d. 6-10

e. other - specify____

13. The <u>primary</u> reason for the laboratory not adapting all of the innovative ideas, concepts, or techniques suggested by interns was:

a. too much effort required to implement

b. too much risk involved

c. they did not meet laboratory's needs

d. ideas suggested by interns were not considered credible

e. other - specify____

14. The restrictions imposed on scientists and engineers in incorporating new innovations at this laboratory were:

a. minimal

b. very reasonable

c. acceptable

d. restrictive

e. excessive

15. I provided a highly specialized or hard-to-find talent that is not normally available to the laboratory.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

16. The internship increased my capability to transfer new concepts or methods that represent technological advances to my next assignment.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

17. Which of the following statements best describes your educational status?

a. received advanced degree before or during internship

b. received advanced degree after internship

c. currently working towards advanced degree

d. intend to begin working toward advanced degree in near future

e. have no immediate plans for working towards advanced degree

18. My advancement pattern is better than my contemporaries.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

19. Which of the following statements best describes the effect of the internship upon your desire to seek a doctorate?

a. encouraged me to seek a doctorate

b. discouraged me from seeking a doctorate

c. no influence - had already decided to seek doctorate

d. no influence - had already decided not to seek doctorate

e. other - specify____________________________________

20. How do you compare yourself in relation to your co-workers in your area of professional knowledge? My knowledge is:

a. far greater
b. greater
c. about the same
d. less
e. far less

21. Compared to my co-workers of equal experience, my annual salary is:

a. much higher
b. higher
c. about the same
d. lower
e. much lower

22. I was very satisfied with the amount of information I got about what was going on at the laboratory.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

23. The way in which scientific information was shared at my laboratory was:

a. outstanding
b. completely satisfactory
c. adequate
d. inadequate
e. entirely unsatisfactory

24. During the internship, I was able to relate in technical areas with ___ other member(s) of the laboratory.

a. 0

b. 1

c. 2-3

d. 4-6

e. other - specify_______________________________

25. my most effective way of exchanging scientific or technical information in the laboratory was:

a. informal discussions on a one-to-one basis

b. informal group meetings

c. written memos or reports

d. formal meetings

e. other - specify_______________________________

26. Which of the following was your major source of scientific or technical information during your internship?

a. other interns that I associated with

b. scientists and engineers from my laboratory

c. scientists and engineers from other activities

d. professional magazines, journals, technical reports, etc

e. other - specify_______________________________

27. My supervisor had an open door policy which was real and useful in terms of providing an opportunity to discuss new ideas.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

28. My major value to the laboratory was:

a. the technical or scientific knowledge I brought with me that was new to the laboratory

b. my background of scientific knowledge that enabled me to develop new concepts

c. my ability to learn, understand, and use concepts that were being used at the laboratory

d. my ability to carry out the technical and scientific instructions given to me by others

e. other - specify________________________________

BIOGRAPHICAL DATA

29. Present position

a. agency________________________________

b. title________________________________

c. time in position________________________________

d. number of professional people supervised__________

30. Previous position (before internship)

a. agency________________________________

b. title________________________________

c. time in position________________________________

d. number of professional people supervised__________

31. Educational level prior to internship________________

32. Briefly describe your duties:

a. immediately prior to the program (preceding year)

____

____

b. during the internship program

____

____

APPENDIX C

Letter to Supervisor

Naval Postgraduate School
Monterey, California 93940
March 22, 1974

Dear

A short time ago, you were contacted by a member of our study team which, at the request of the National Science Foundation, is conducting a follow-up study of the Presidential Internships in Science and Engineering Program. The information that you provided has been most helpful in enabling the team to locate an adequate number of interns to proceed with the study.

The enclosed questionnaires are intended to serve as a primary source of data for the study. We are again requesting your help by asking you to distribute these questionnaires to the individuals whom the interns worked for during the internship period or those people who are most qualified to evaluate the interns' efforts during the internship.

It is requested that these questionnaires be completed and returned to the study team via the return-addressed envelopes. In the event that a supervisor was responsible for more than one intern, only one copy of Part I of the questionnaire need be completed by that supervisor, while a copy of Part II should be completed for each intern.

Please be assured that all responses will be held in the strictest confidence and under no circumstances will the study report make references to specific individuals or laboratories.

Your support and cooperation in carrying out this

study is greatly appreciated by the team members. If you have any questions or comments regarding the study, please don't hesitate to contact us.

Sincerly,
Dr. J.W. Creighton
Code 55CFC
Phone (408)646-2048

PRESIDENTIAL INTERNSHIPS IN SCIENCE AND ENGINEERING

CENSUS OF AGENCY REPRESENTATIVES

PART I

REPRESENTATIVE'S NAME____

Each question requires that you circle one answer only. Please answer all of the questions in the census.

This section relates to the laboratory only at the time of the internship and not to the present.

1. The management of this laboratory encourages its members to incorporate innovative ideas, concepts, and techniques.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

2. The management of this laboratory gives individual recognition and/or financial rewards to members who suggest new ideas that are accepted by the laboratory.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

3. The restrictions imposed by top management on scientists and engineers in incorporating new innovations are:

a. minimal
b. very reasonable
c. acceptable
d. restrictive
e. excessive

4. This laboratory's policy was to encourage those interns who had not yet earned advance degrees to do so.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

5. Top management was effective in keeping the scientists and engineers posted about what was going on at the laboratory.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

6. The routine formal paperwork requirements at this laboratory are quite detailed and often seem very unproductive.

a. strongly agree
b. agree
c. undecided
d. disagree
e. strongly disagree

7. I have observed that the most effective way that scientific information and technology were exchanged in this laboratory during the internship period was:

a. informal discussions on a one-to-one basis
b. informal group meetings
c. written memos or formal reports
d. formal meetings
e. other - specify ________________________________

8. The *major* method of obtaining scientific information or technology at this laboratory is:

a. discussions among scientists and engineers assigned to the laboratory

b. discussions between laboratory members and scientists, engineers, and educators from other activities

c. written reports originated and distributed within the laboratory

d. written information from outside sources

e. other - specify ________________________________

PART II

REPRESENTATIVE'S NAME_______________________________________

INTERN'S NAME____

Each question requires that you circle one answer only. Please answer all of the questions in the census.

This section applies only to the intern indicated above and to the period of his internship.

1. After completion of this program, you did/will favorably recommend this intern for future employment.

   a. strongly agree
   b. agree
   c. undecided
   d. disagree
   e. strongly disagree

2. How long did it take for the intern to become a productive member of the laboratory?

   a. 0-2 months
   b. 3-4 months
   c. 5-6 months
   d. 7-12 months
   e. other - specify_____________________________________

3. This intern was assigned to a department that had <u>few</u> changes in personnel.

   a. strongly agree
   b. agree
   c. undecided
   d. disagree
   e. strongly disagree

4. This intern became a productive member of the laboratory faster than most other new members.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

5. During his internship, how many non-routine, work-related projects have been completed for which this intern supplied the original idea?

a. 0

b. 1-2

c. 3-4

d. 5-6

e. other - specify____

6. I went more frequently to this intern than any other one of his co-workers for work-related information and/or advice which was <u>not</u> a function of their formal positions.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

7. Most of the innovative ideas or techniques that were suggested by this intern were accepted by the laboratory.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

8. The primary reason for this laboratory not adapting all of the innovative ideas, concepts, or techniques suggested by this intern was:

a. too much effort required to implement

b. too much risk involved

c. they didn't meet the laboratory's needs

d. they were not practical

e. other - specify_______________________________________

9. This intern provided a highly specialized or hard-to-find talent that is not normally available to your laboratory.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

10. The internship program increased this intern's capability to transfer new concepts or methods that represent technological advances to his next assignment.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

11. This intern's advancement pattern is better than that of his co-workers'.

a. strongly agree

b. agree

c. undecided

d. disagree

e. strongly disagree

12. How do you compare this intern's professional knowledge with that of his co-workers who have equivalent positions in your agency? The intern's knowledge is:

a. far greater

b. somewhat greater

c. the same

d. somewhat less

e. far less

13. If this intern had a new idea he thought would be a useful concept to the laboratory, he would be most likely to:

a. discuss it with his associates

b. discuss it with his superior

c. write a memo or report

d. implement it on his own authority

e. other - specify_____________________________________

14. This intern's major contribution to the laboratory was:

a. the technical or scientific knowledge that he brought with him that was new to the laboratory

b. his background of scientific knowledge that enabled him to develop new concepts

c. his ability to learn, understand, and use concepts that were being used at the laboratory

d. his ability to carry out technical and scientific instructions given by others

e. other - specify_____________________________________

APPENDIX D

Explanation of Statistical Usage and Inferences

D(1). The standard error was computed for the three separate sample groups which included:

Group 1 - interns

Group 2 - supervisors

Group 3 - matched interns and supervisors

The following equation for samples taken from small populations without replacement was used:

$$S.E. = \left[\frac{Ps(1-Ps)(N-n)}{n(N-1)}\right]^{\frac{1}{2}}$$

where

S.E. = standard error

Ps = proportion of population having a particular characteristic

N = population size

n = sample size

The population size (N) was 557 for all three groups and the worst case value of Ps = 0.50 was assumed to exist for the standard error computations. For the sample sizes n = 87, 50, and 31 for groups 1, 2, and 3 respectively, standard errors of 0.0493, 0.0675, and 0.0873 were obtained.

Using a confidence level of 95% and assuming a normal distribution, the standard errors computed above indicated that the sample would not deviate from the population by more than 9.66%, 13.2%, and 17.1% for the three respective groups.

D(2). The chi-square statistic (signified by X^2) was utilized to determine whether the responses to various

combinations of intern-supervisor questions were inter-dependent. The chi-square statistic can be calculated as follows:

$$X^2 = \frac{(f_a - f_e)^2}{f_e}$$

where

f_a = actual observed frequency

f_e = theoretical expected frequency

The significance level of X^2 is dependent upon the number of degrees of freedom (d.f.) that are determined from a contingency table by:

d.f. = (number of rows-1) (number of columns-1)

Once the values of X^2 have been calculated, the chi-square table can be used to determine the significance level of the combination of variables that are being tested for inter-dependence.

The null hypothesis assumes that the two variables are independent. If a significance level less than that predetermined to be adequate protection against the risks of incorrectly identifying inter-dependent relationships is obtained, the null hypothesis is rejected and the two variables are considered to be dependent. Larger values of significance levels result in acceptance of the null hypothesis and the variables are assumed to be independent.

For this study, a significance level of 5% was considered appropriate to make the decisions regarding inter-dependence of the questions being compared.

D(3). The Pearson Product-Moment Correlation Coefficients (symbolized by the Greek letter rho) were computed for all possible combinations of intern questions matched against supervisor questions.

Rho is essentially an index of the degree of straight-line relationship between the two variables being compared. Computed values of rho (signified by the letter r) are obtained for two variables X and Y as follows:

$$r = \frac{S_{XY}}{(S_X)^2(S_Y)^2}$$

where

$\bar{X}$ = mean value of variable X

$\bar{Y}$ = mean value of variable Y

$(X-\bar{X})$ = difference between specific values of X and $\bar{X}$

$(Y-\bar{Y})$ = difference between specific values of Y and $\bar{Y}$

$(S_X)^2$ = sum of all values of $(X-\bar{X})$

$(S_Y)^2$ = sum of all values of $(Y-\bar{Y})$

S_{XY} = sum of all values of $(X-\bar{X})(Y-\bar{Y})$

The possible values of r range from +1.0 to -1.0. The sign of r indicates whether the relationship between X and Y is direct or inverse. An r value of +1.0 indicates a perfect one-to-one direct correlation, an r value of zero means no linear correlation, and an r value of -1.0 indicates a perfect one-to-one inverse relationship.

If scatter diagrams were plotted for the various combinations of questions that were compared in the study, those comparisons having the larger r values would show a lessor degree of scatter about a 45 degree straight line originating at the intersection of the X and Y axis than would those comparisons that yield smaller r values.

The use of this correlation coefficient is restricted to instances where the underlying association between X and Y is believed to be linear. For comparisons giving r values of zero, the conclusion that no relationship exists may be fallacious since the possibility of a non-linear relationship still very much exists.

Significance levels were obtained for each of the r values. These significance figures give the probability

that, for their associated r values, rho does not equal zero. For example, a significance level of 5% would indicate that there is a 5% or less chance that no linear correlation exists between the variables being compared.

Significance levels can be determined by using the Student t distribution in conjunction with the following equation:

$$t = r\left[(n-2)/(1-r^2)\right]^{\frac{1}{2}}$$

where

n = the sample size

(n-2) = degrees of freedom to use with the Student t table

t = figure used to determine significance level from the Student t table

For this study, the sample size of the matched intern-supervisor questionnaires was n = 31. It was possible to solve for the minimum r values that would produce a desired significance level. For this study, a significance level of 5% was chosen and the corresponding r value was determined to be 0.355. Smaller values of r were assumed to be indicative of relatively insignificant degrees of correlation between the questions being compared.

LIST OF REFERENCES

1. Allen, Thomas J., "Performance of Information Channels in the Transfer of Technology," Industrial Management Review, VIII (1966), pp. 87-98.

2. Barnett, H.G., Innovation: The Basis of Cultural Change. New York: McGraw-Hill Book Company, 1953.

3. Blackwell, Roger D., "Word of Mouth Communication by the Innovator," Journal of Marketing, XXXIII (July 1969), p. 19.

4. Creighton, J.W., Jolly, J.A., and Denning, S.A., Enhancement of Research and Development Output Utilization Efficiencies; Linker Concept Methodology in the Technology Transfer Process. Naval Postgraduate School, Monterey, Ca, 1972 (NPS-550c0f720610A).

5. Engle, James F., Blackwell, Roger D., and Kegerreis, Robert J., "How Information is used to Adopt an Innovation," Journal of Advertising Research, IX (September, 1969), p. 4.

6. Gruber, W.H., and Marquis, D.G., "Research on the Human Factor in the Transfer of Technology," in William H. Gruber and Donald G. Marquis, ed. Factors in the Transfer of Technology. Cambridge, Mass.: M.I.T. Press, 1969.

7. Havelock, R.G., et. al., Planning for Innovation Through Dissemination of Utilization of Knowledge. Ann Arbor, Michigan: Institute for Social Research, Univ. of Michigan, 1971.

8. McDonough, Adrian M., Information Economics and Management Systems. New York: McGraw-Hill, 1963.

BIBLIOGRAPHY

Bureau of Intergovernmental Personnel Programs, *The IPA Title IV Intergovernmental Assignment Program,* 1973 Report.

Claassen, S.H. *Technology Transfer as Applied to Government Employees of the Naval Facility Engineering Command and Compared to Naval Officers of the Civil Engineering Corps,* a thesis submitted to the Naval Postgraduate School, Sept. 1973.

Dealing With Technological Change, Selected essays from Innovation, the magazine about the art of managing advancing technology, Auerback Publishers, 1971.

Doctors, Samuel *The Role of Federal Agencies in Technology Transfer,* Cambridge: The M.I.T. Press, 1969.

Federal Personnel Manual, chapter 334.

Havelock, R.G., and Benn, K.D., "An Exploratory Study of Knowledge Utilization," in G. Watson, *Concepts for Social Change*, Washington, D.C.: NTL Institute for Applied Behavioral Science, 1967.

Lamont, Lawrence M., *Technology Transfer, Innovation, and Marketing in Science-oriented Spin-off Firms,* Ann Arbor: Institute of Science and Technology, The University of Michigan, 1971.

Lapin, Lawrence L., *Statistics for Modern Business Decisions,* Harcourt Brace Jovanovich, Inc., 1973.

Nie, Norman H., Bent, Dale H., and Hull, C. Hadlai, *Statistical Package for the Social Sciences,* McGraw-Hill, 1970.

Snedecor, George W., Statistical Methods, the Iowa State Press, 1948.

United States Civil Service Commission, Report on Personnel Mobility Under the Intergovernmental Personnel Act, Bulletin No. 334-6, Sept, 6, 1973.

Welles, John G. and Waterman, Robert H. Jr., Space Technology: Pay-off From Spin-off, Harvard Business Review, July-August, 1964, p106-118.

Wonnacott, Thomas H. and Wonnacott, Ronald J., Introductory Statistics, John Wiley & Sons; Inc., 1972.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Documentation Center Cameron Station Alexandria, Virginia 22314	2
2.	Library, Code 0212 Naval Postgraduate School Monterey, California 93940	2
3.	Department Chairman, Code 55SO Department of Operations Research and Administrative Sciences Naval Postgraduate School Monterey, California 93940	2
4.	Professor J.W. Creighton, Code 55Cf Department of Operations Research and Administrative Sciences Naval Postgraduate School Monterey, California 93940	20
5.	Professor J.A. Jolly, Code 55Jo Department of Operations Research and Administrative Sciences Naval Postgraduate School Monterey, California 93940	1
6.	Harold F. Metcalf National Science Foundation Intergovernmental Science and Research Utilization Rm. 537 1800 "G" Street N.W. Washington, D.C. 20550	1

7. LCDR. C.E. Cater, USN 1
1706 N. Balda Rd.
Oak Harbor, Washington 98277

8. LCDR. T.E. Korsmo, USN 1
12815 Firbrook Lane
Poway, California 92064

152233
Thesis
C327 Cater
c.1 A study of the presidential internships in science and engineering.